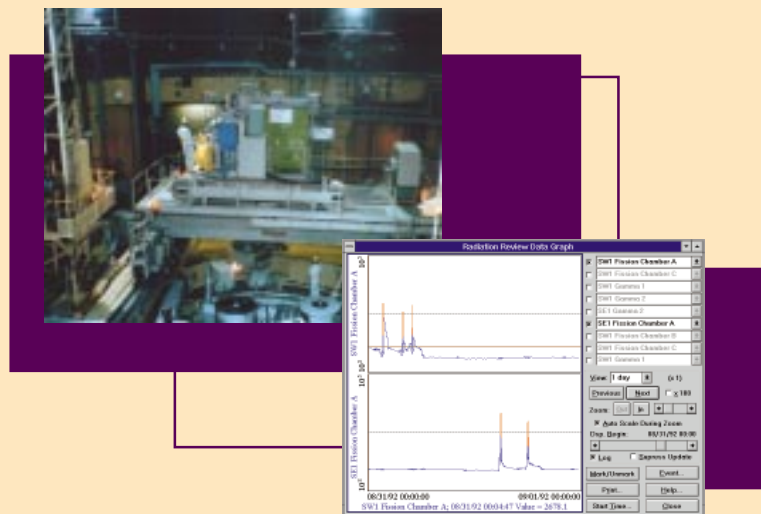




Los Alamos National Laboratory



Monitoring Special Nuclear Material

- Detect plutonium, uranium or spent fuel
- Video images triggered by radiation detection
- Reconcile facility declaration, using radiation and video monitoring

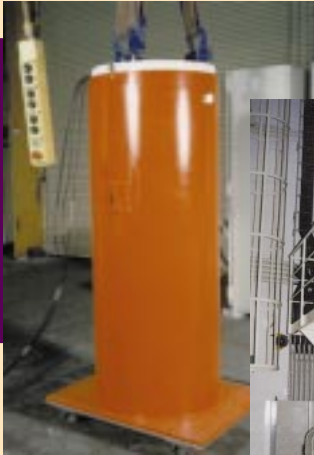
Safeguards Science and Technology Group (NIS-5)
Group Leader: Avigdor Gavron, Phone: 505-667-7110 Nonproliferation and International Security Division
Supported by FSU MPC&A Task Force (NN-40), International Safeguards Division (NN-44),
and International Policy and Analysis Division (NN-42) in the Department of Energy

LALP-98-141

Unattended Monitoring and Remote NDA

Plutonium Canister Assay System (PCAS) measures Plutonium oxide input to the MOX plant

INPUT



OUTPUT

Fuel Assembly Assay System (FAAS) measures output MOX fuel assembly

HOLDUP

Glove-Box Assay System (GBAS) assays the holdup in glove boxes



PROCESS

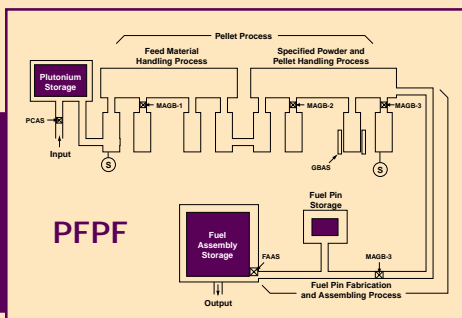


Material Assay Glove-Box (MAGB) counters provide inventory measurements of MOX samples in process lines

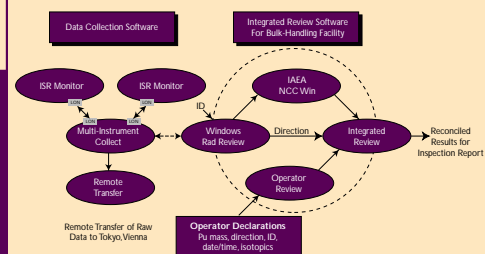
UNATTENDED NDA SYSTEMS

- Accepted for IAEA inspection
- Operational for more than ten years
- No loss of data in continuous operation
- Full material balance accounting

MOX FABRICATION PLANT



REMOTE NDA Future of international inspection



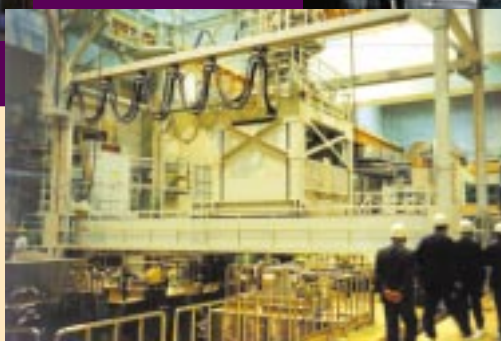
Integrated Radiation and Video Monitoring



Radiation and Video Network Electronics



Radiation Detectors and Video Camera



Spent Fuel Pond

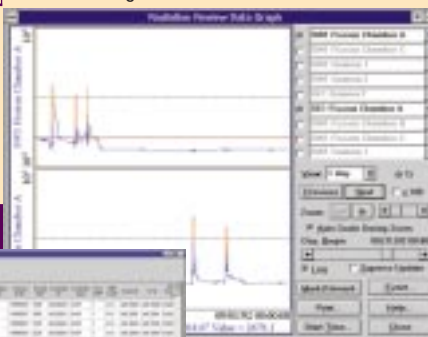
- Reconcile data
- Generate inspection reports
- Control other review tools

Integrated Review

[illegible]

Radiation Review

- Neutron and gamma detector
 - Plutonium
 - Uranium
 - Spent fuel
- Automated event detection
 - Time of movement
 - Direction of movement
 - Neutron/gamma ratio



Video Review



- Digital or analog images
- Triggered by radiation detection
- Minimal disk storage needed

The screenshot displays the 'EMPLOYEE' table in the 'SCOTT' schema. The data is as follows:

EMPLOYEE_ID	LAST_NAME	FIRST_NAME	EMAIL	PHONE_NUMBER	HIRE_DATE	JOB_ID	SALARY	COMMISSION_PCT	MANAGER_ID
100	SCOTT	TIGER	SCOTT.TIGER@oracle.com	(919) 555-1000	1987-06-07	ANALYST	3000	0.00	900
900	KING	STEVEN	STEVEN.KING@oracle.com	(919) 555-1001	1981-05-14	PRESIDENT	9500	0.00	
101	DEER	STEVEN	STEVEN.DEER@oracle.com	(919) 555-1002	1981-05-14	MANAGER	8000	0.00	900
102	BLAKE	ALLEN	ALLEN.BLAKE@oracle.com	(919) 555-1003	1981-05-14	MANAGER	7800	0.00	900
103	CLARK	WENDY	WENDY.CLARK@oracle.com	(919) 555-1004	1981-05-14	CLERK	2800	0.00	900
104	ADAMS	JAMES	JAMES.ADAMS@oracle.com	(919) 555-1005	1981-05-14	CLERK	2600	0.00	900
105	MARTIN	MARTIN	MARTIN.MARTIN@oracle.com	(919) 555-1006	1981-05-14	SALESREP	2900	0.00	900
106	SMITH	JOHN	JOHN.SMITH@oracle.com	(919) 555-1007	1981-05-14	CLERK	2700	0.00	900
107	WARD	WARD	WARD.WARD@oracle.com	(919) 555-1008	1981-05-14	SALESREP	2500	0.00	900
108	MILLER	WALTER	WALTER.MILLER@oracle.com	(919) 555-1009	1981-05-14	CLERK	2200	0.00	900
109	TURNER	TURNER	TURNER.TURNER@oracle.com	(919) 555-1010	1981-05-14	SALESREP	2800	0.00	900
110	POWERS	ANDREW	ANDREW.POWERS@oracle.com	(919) 555-1011	1981-05-14	SALESREP	2500	0.00	900
111	FUTCHER	DEAN	DEAN.FUTCHER@oracle.com	(919) 555-1012	1981-05-14	SALESREP	2300	0.00	900
112	COOPER	MICHAEL	MICHAEL.COOPER@oracle.com	(919) 555-1013	1981-05-14	SALESREP	2500	0.00	900

Operator Review

- Display facility operation
 - Loading or unloading fuel
 - Time of fuel movement
 - Characteristics of fuel

Evolution of NDA Measurements and Remote Monitoring

Portable NDA

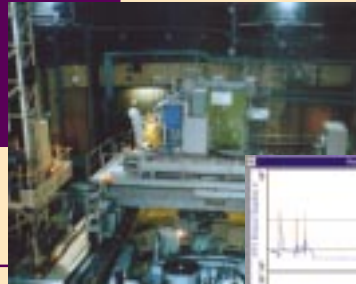
1973



Unattended NDA

1987

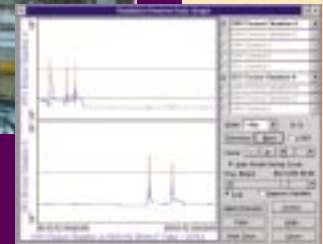
- Quantity



Integrated NDA and Radiation Monitoring

1992

- Quantity
- Movements



Integrated NDA, Video, and Radiation Monitoring Reconciliation

1997

- Quantity
- Movements
- Operation



Time	Location	Status
1997-01-01 00:00	Area 1	Normal
1997-01-01 01:00	Area 2	Warning
1997-01-01 02:00	Area 1	Normal
1997-01-01 03:00	Area 3	Warning
1997-01-01 04:00	Area 1	Normal
1997-01-01 05:00	Area 2	Warning
1997-01-01 06:00	Area 1	Normal
1997-01-01 07:00	Area 3	Warning
1997-01-01 08:00	Area 1	Normal
1997-01-01 09:00	Area 2	Warning
1997-01-01 10:00	Area 1	Normal
1997-01-01 11:00	Area 3	Warning
1997-01-01 12:00	Area 1	Normal
1997-01-01 13:00	Area 2	Warning
1997-01-01 14:00	Area 1	Normal
1997-01-01 15:00	Area 3	Warning
1997-01-01 16:00	Area 1	Normal
1997-01-01 17:00	Area 2	Warning
1997-01-01 18:00	Area 1	Normal
1997-01-01 19:00	Area 3	Warning
1997-01-01 20:00	Area 1	Normal
1997-01-01 21:00	Area 2	Warning
1997-01-01 22:00	Area 1	Normal
1997-01-01 23:00	Area 3	Warning



Remote Transmission

1999

- Quantity
- Movements
- Operation
- Remote

